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TRANSMITTAL LETTER TO THE UNITED STATES
DESIGNATED/ELECTED OFFICE (10/EO/US)
CONCERNING A FILING UNDER 35 U.S.C. 371

INTERNATIONAL APPLICATION NO.

PCT/EP00/09177

INTERNATIONAL FILING DATE

Sept. 20, 2000

PRIORITY DATE CLAIMED

Sept. 23, 1999

TITLE OF INVENTION APPARATUS HAVING AT LEAST TWO PROCESSING STATIONS AND A
DEVICE FOR LOADING AND UNLOADING SUBSTRATES

APPLICANT(S) FOR DOMESTIC

Klaus Weber, Martin Söman, Jürgen Kallis

Applicant herewith submits to the United States Designated/Elected Office (10/EO/US) the following items and other information:

1. ☒ This is a FIRST submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a SECOND or SUBSEQUENT submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (21) indicated below.
4. ☒ The US has been elected by the expiration of 19 months from the priority date (Article 31).
5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
 - a. ☐ is attached hereto (required only if not communicated by the International Bureau).
 - b. ☒ has been communicated by the International Bureau.
 - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☒ An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
 - a. ☒ is attached hereto.
 - b. ☐ has been previously submitted under 35 U.S.C. 154(d)(4).
7. ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
 - a. ☐ are attached hereto (required only if not communicated by the International Bureau).
 - b. ☐ have been communicated by the International Bureau.
 - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
 - d. ☐ have not been made and will not be made.
8. ☐ An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☐ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☐ An English language translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11 to 20 below concern document(s) or information included:

11. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☒ A FIRST preliminary amendment.
14. ☐ A SECOND or SUBSEQUENT preliminary amendment.
15. ☐ A substitute specification.
16. ☐ A change of power of attorney and/or address letter.
17. ☐ A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825.
18. ☐ A second copy of the published international application under 35 U.S.C. 154(d)(4).
19. ☐ A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).
20. ☐ Other items or information:

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I hereby certify that this paper or fee is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 on the date indicated above and is addressed to the Commissioner of patents and trademarks, Washington, D.C. 20231.

Rosalie A. Centeno

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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Rosalie A. Centeno
Rosalie A. Centeno, Secretary

In the Application of Klaus Weber et al

Ser.No.: Not Yet Known (Based on PCT/EP00/09177 filed 20 September 2000 and DE 199 45 648.8 filed 23 September 1999)

For: APPARATUS FOR THE LOADING AND UNLOADING OF SUBSTRATES

Filed on: March 22, 2002

Assistant Commissioner for Patents

Washington, DC 20231

PRELIMINARY AMENDMENT ACCOMPANYING PCT NATIONAL STAGE APPLICATION

Sir:

Prior to examination, please amend the above-identified application as follows.

IN THE SPECIFICATION:

On page 1, please replace the existing title with the following:

--Apparatus Having at Least Two Processing Stations and a Device for Loading and Unloading Substrates--

On page 1, immediately after the title, please insert the following heading:

--Background of the Invention--.

On page 3, between lines 16 and 17, please insert the following heading:

--Summary of the Invention--.

On page 6, between lines 11 and 12, please insert the following heading:

--Brief Description of the Drawings--;

On page 7, before line 1, please insert the following heading:

--Description of Preferred Embodiments--.

On page 10 beginning at line 18 and continuing through to page 11, line 2, please replace the existing paragraph with the following:

--The center points, 40,65 of the circumferential circles 41,66 of the first and second groups of the arrangement 1 are spaced upon the linear conveying device 3 by a distance equal to three times the spacing d between adjacent carriers. The diameters of the two circumferential circles 41 and 66 are the same, and correspond to two times the spacing d between adjacent carriers upon the conveyor belt 13.--

On page 12 beginning at line 21 and continuing through to page 13, line 4, please replace the existing paragraph with the following:

--The linear conveying device 3a has a track or line 14a upon which is disposed a conveyor belt 13a. As described above for the conveyor belt 13 of the first embodiment, the conveyor belt 13a also extends between two reversing ends 15a and 16a of the linear conveying device 3a, and is driven by means of a drive roller 18a at the reversing end 16a by a suitable drive means 19a, such as a controlled servomotor.--

On page 16 beginning at line 11 and continuing to line 17, please replace the existing paragraph with the following:

--As soon as the loaded carriers 22,24,25 and 27 are disposed upon the circumferential circles 41 or 46, the handling devices 4 and 5 are rotated into the position shown in Figure 1, in which the receivers 42 to 47 are disposed either over the central receiving points 60A to 60C or over the carriers 22 and 24. The same applies for the second group of the arrangement 1, which comprises the handling device 5, the four processing stations 7A to 7D, and the conveyor belt 13.-

On page 20, after line 8, please insert the following paragraphs:

--The specification incorporates by reference the disclosure of German priority document 199 45 648.8 filed September 23, 1999 and International priority document PCT/EP00/09177 filed September 20, 2000.

The present invention is, of course, in no way restricted to the specific disclosure of the specification and drawings, but also encompasses any modifications within the scope of the appended claims.--

IN THE CLAIMS:

Please cancel claims 1 - 19, and replace them with the attached claims 20 - 38.

REMARKS

Claims 20 - 38 are pending in the application.

Appropriate headings have been added to the specification, and claims from the literal translation have been replaced by claims drafted in conformity with U.S. Patent practice.

The application in its amended state is believed to be in condition for allowance. However, should the Examiner have any comments or suggestions, or wish to discuss the merits of the application, the undersigned would very much welcome a telephone call in order to expedite placement of the application into condition for allowance.

Respectfully submitted,



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VERSION WITH MARKINGS TO SHOW CHANGES MADE**In The Specification:**

On page 1, please replace the existing title with the following:

Apparatus Having at Least Two Processing Stations and a Device for [the] Loading and Unloading [Of] Substrates

On page 10 beginning at line 18 and continuing through to page 11, line 2, please replace the existing paragraph with the following:

The center points, 40,65 of the circumferential circles 41,66 of the first and second groups of the arrangement 1 are spaced upon the linear conveying device 3 by a distance equal to three times the spacing d between adjacent carriers. The diameters of the two circumferential circles 41 and 66 are the same, and correspond to two times the spacing d between adjacent carriers upon the conveyor belt 13.

On page 12 beginning at line 21 and continuing through to page 13, line 4, please replace the existing paragraph with the following:

The linear conveying device [4] 3a has a track or line 14a upon which is disposed a conveyor belt 13a. As described above for the conveyor belt 13 of the first embodiment, the conveyor belt 13a also extends between two reversing ends 15a and 16a of the linear conveying device 3a, and is driven by means of a drive roller 18a at the reversing end 16a by a suitable drive means 19a, such as a controlled servomotor.

On page 16 beginning at line 11 and continuing to line 17, please replace the existing paragraph with the following:

—As soon as the loaded carriers 22,24,25 and 27 are disposed upon the circumferential circles 41 or 46, the handling devices 4 and 5 are rotated into the position shown in Figure 1, in which the receivers 42 to 47 are disposed either over the central receiving points 60A to 60C or over the carriers 22 and 24. The same applies for the second group of the arrangement 1, which

comprises the handling device 5, the four processing stations 7A to 7 [C] D, and the conveyor belt 13.

20. An apparatus for loading substrates upon and unloading substrates from at least two processing stations, wherein said apparatus is provided with a conveying device for a linear transport of substrates, and at least one rotatable handling device for transporting substrates between said conveying device and said processing stations, wherein said conveying device is disposed between said at least two processing stations, and wherein said at least one handling device is disposed above said conveying device.

21. An apparatus according to claim 20, wherein a point of rotation of said at least one handling device is disposed upon a central axis of said conveying device.

22. An apparatus according to claim 20, wherein said at least one handling device is provided with receivers for substrates, and wherein said receivers are disposed upon a circumferential circle.

23. An apparatus according to claim 22, wherein said receivers are uniformly spaced apart upon said circumferential circle.

24. An apparatus according to claim 22, wherein said at least one handling device is provided with radial arms, and wherein said receivers are disposed on said arms.

25. An apparatus according to claim 20, wherein said conveying device is provided with a conveyor belt.

26. An apparatus according to claim 25, wherein said conveyor belt extends between a loading station and an unloading station.

27. An apparatus according to claim 25, wherein said conveyor belt is provided with carriers for substrates.

28. An apparatus according to claim 27, wherein said carriers are uniformly spaced apart in a direction of movement of said conveyor belt.

29. An apparatus according to claim 27, wherein said carriers are disposed on a central axis of said conveyor belt.

30. An apparatus according to claim 27, wherein respectively at least two of said carriers are symmetrically disposed relative to a central axis of said conveyor belt.

31. An apparatus according to claim 27, wherein for a loading and unloading of substrates, at least two of said carriers are adapted to be disposed upon said circumferential circle.

32. An apparatus according to claim 22, wherein central receiving points of said processing stations are disposed upon said circumferential circle.

33. An apparatus according to claim 32, wherein said processing stations are disposed in pairs diametrically across from one another upon said circumferential circle.

34. An apparatus according to claim 33, wherein the processing stations within said pairs are of the same type.

35. An apparatus according to claim 22, wherein a common drive means is provided for driving those processing stations that are disposed adjacent one another upon said circumferential circle.

20. An apparatus (2) for loading substrates upon and unloading substrates from at least two processing stations, wherein said apparatus is provided with a conveying device (3) for a linear transport of substrates, and at least one rotatable handling device (4, 5; 4a) for transporting substrates between said conveying device and said processing stations, wherein said conveying device (3) is disposed between said at least two processing stations, and wherein said at least one handling device (4, 5; 4a) is disposed above said conveying device.

21. An apparatus according to claim 20, wherein a point of rotation (40, 65; 40a) of said at least one handling device (4, 5; 4a) is disposed upon a central axis (20, 20b, 20a) of said conveying device (3).

22. An apparatus according to claim 20, wherein said at least one handling device (4, 5; 4a) is provided with receivers (42-47; 400a-411a) for substrates, and wherein said receivers are disposed upon a circumferential circle (41, 66; 41a).

23. An apparatus according to claim 22, wherein said receivers are uniformly spaced apart upon said circumferential circle.

24. An apparatus according to claim 22, wherein said at least one handling device (4, 5; 4a) is provided with radial arms (48-53; 420; 431) and wherein said receivers (42-47; 400a-411a) are disposed on said arms.

25. An apparatus according to claim 20, wherein said conveying device (3) is provided with a conveyor belt (8).

* for Examiners Reference

26. An apparatus according to claim 25, wherein said conveyor belt (13) extends between a loading station and an unloading station.

27. An apparatus according to claim 25, wherein said conveyor belt (13) is provided with carriers (21-28; 21a-28a) for substrates.

28. An apparatus according to claim 27, wherein said carriers are uniformly spaced apart in a direction of movement of said conveyor belt (13).

29. An apparatus according to claim 27, wherein said carriers (21-28) are disposed on a central axis (20, 20a, 20b) of said conveyor belt (13; 13b).

30. An apparatus according to claim 27, wherein respectively at least two of said carriers (21a-28b) are symmetrically disposed relative to a central axis (20a) of said conveyor belt (13a).

31. An apparatus according to claim 27, wherein for a loading and unloading of substrates, at least two of said carriers (21-28; 21a-28a) are adapted to be disposed upon said circumferential circle (41, 66; 41a).

32. An apparatus according to claim 22, wherein central receiving points (60A-D; 81A-H) of said processing stations (6A-D; 80A-H) are disposed upon said circumferential circle (41; 41a).

33. An apparatus according to claim 32, wherein said processing stations are disposed in pairs diametrically across from one another upon said circumferential circle (41, 66; 41a)

34. An apparatus according to claim 33, wherein the processing stations within said pairs are of the same type.

35. An apparatus according to claim 22, wherein a common drive means is provided for driving those processing stations (80A-H) that are disposed adjacent one another upon said circumferential circle (41a)

36. An apparatus according to claim 31, wherein the number of said receivers (42-47; 400a-411a) of said at least one handling device (4; 4a) corresponds to the number of said carriers (22, 24; 22a, 23a, 26a, 27a) that are disposed upon said circumferential circle (41; 41a) for loading and unloading, and of said processing stations (6A-D; 80A-H)

37. An apparatus according to claim 36, wherein during loading and unloading all of said receivers (42-47; 400a-411a) are disposed either over said carriers (22, 24, 25, 27; 22a, 23a, 26a, 27a) on said conveying device (3), or over central receiving points of said processing stations (6A-D, 7A-D; 80A-H)

38. An apparatus according to claim 22, wherein a control device is provided for a simultaneous opening and closing of said receivers (42-47; 400a-411a)

3/p.12

APPARATUS FOR THE LOADING AND UNLOADING OF
SUBSTRATES

5 The present invention relates to an apparatus for the loading and unloading of substrates and includes a conveying device for the linear transport of the substrates and at least one rotatable handling device for the transport of the substrates between the conveying device and at least one processing station.

10 Apparatus for the loading and unloading of substrates of the above type are known, for example, in arrangements for the processing of substrates, and in particular in arrangements for the lacquering or coating of substrates. In such arrangements substrates, for example CD/CD-R/DVD and other data storage means or data carriers, for the
15 lacquering or the coating, are removed by a first handling device from a feed device and are deposited on a processing station, such as a lacquering station. After the processing, the substrate is again taken up by a second handling device and is deposited upon a device for transporting it away or is supplied to a further process.

20 US-A-4,824,309 discloses a vacuum processing unit having a vacuum pre-chamber, a buffer chamber and a processing chamber. The unit has a first wafer carrier in the buffer chamber, as well as a second wafer carrier, in order to transport wafers from the vacuum pre-chamber to the first wafer carrier in the buffer chamber. A third wafer

carrier is furthermore provided that transports the wafer from the first wafer carrier to the processing chamber, whereby the second and third wafer carriers are provided with conveyor belts.

5 The Speedline prospectus of the Leybold Systems Company, 2/97, pages 6 to 9, shows an integrated CD-manufacturing apparatus where different process units for the manufacturer of CD's are integrated into an arrangement. For the transport of elements that form the CD's, conveyor belts as well as mechanical grippers are utilized.

10 DE-C-197 22 408 shows an apparatus and a method for the separated transport of substrates upon two separated transport stretches, with two supply stations, at least two processing stations, and two delivery stations. A transport device for the transport of the substrates is rotatable about an axis of rotation by a first angle, and has at least two grippers that are disposed along a circular arc about
15 the axis of rotation at a prescribed angular spacing. The angular spacing between the two supply stations, between the two processing stations and between the two delivery stations is respectively equal to the prescribed angular spacing, and the first angle is greater than the prescribed angle.

20 A further device for carrying out different processes from a work piece is known from DE-C-41 27 341. The work pieces are transported to and away from a rotary switching table via a linearly movable transport carriage having respectively three transport arms arranged on

both sides of the carriage. The rotary switching table leads the work pieces to various processing stations.

Further reference is made to US-A-5,700,127, which shows a substrate processing apparatus having various processing units. The substrates are supplied to and removed from the various processing units via a handling device. The handling device has a substrate gripper that is linearly movable in the x, y and z directions, and is rotatable about the z axis.

With such apparatus, for the loading and unloading of a processing station separate handling devices as well as separate feed and discharge devices are provided. This results in a greater requirement for space for the components of the apparatus, which in particular in clean room environments leads to high costs.

Proceeding from such apparatus, it is an object of the present invention to provide an economical apparatus having a low number of components and requiring less space.

This object is inventively realized with an apparatus where the conveying device is disposed between two processing stations and the at least one handling device is disposed over the conveying device. The arrangement of the conveying device between at least two processing stations has the advantage that due to the rotatable handling device that is disposed over the conveying device, a plurality

of processing stations can be provisioned with a low requirement for space.

Pursuant to one preferred embodiment, the point of rotation of the handling device is disposed on a central axis of the conveying device. The handling device preferably has receiving devices disposed on a circumferential circle for the substrates, which are preferably uniformly spaced upon the circumferential circle. This results in a circular symmetry that by a rotational movement of the handling device enables the simple loading and unloading of a plurality of processing stations.

So that the processing stations are not covered during the processing of substrates, and to avoid media from being carried off, the receivers are preferably disposed on radial arms of the handling device in order to provide free spaces between them.

The linear conveying device is advantageously a conveyor belt that preferably extends between a loading station and an unloading station. This has the advantage that for the feeding and discharging of the substrates only a single conveyor belt is required, thereby reducing the number of components that are needed.

Pursuant to a particularly preferred embodiment, the conveyor belt is provided with carriers for a reliable holding and a defined positioning of the substrates. In this connection, it is advantageous that the carriers be uniformly spaced on the conveyor belt in the

direction of movement in order to simplify the control of the conveyor belt, whereby constant movement intervals can be provided. For the formation of a symmetry relative to the handling device, the carriers are disposed on the central axis of the conveyor belt, or at least two carriers are symmetrically disposed relative to the central axis of the conveyor belt, thereby simplifying the control of the handling device.

It is also advantageous if at least two carriers are disposed on the circumferential circle for the loading and unloading of the substrates in order to make possible the simultaneous receipt and/or deposit of a plurality of substrates.

Pursuant to one preferred embodiment, central receiving points of the processing stations are disposed on the circumferential circle, preferably being disposed in pairs diametrically across from one another on the circumferential circle.

In this connection, the processing stations are preferably of the same type within the pairs. This again increases the symmetry of the apparatus and thus simplifies the control of the handling device.

It is of particular advantage if processing stations that are disposed adjacent one another on the circumferential circle are provided with the same drive means, which reduces the number of drive means required and the cost connected therewith.

The number of receiving devices of the handling device advantageously corresponds to the number of carriers disposed upon

the circumferential circle and the processing stations. This enables an effective loading and unloading of all of the processing stations and carriers upon the circumferential circle in one operation. In this connection, during the loading and unloading, preferably all of the receivers are disposed either over the carriers upon the conveying device or over the receiving points of the processing stations.

Pursuant to one preferred embodiment, a control device is provided for the simultaneous opening and closing of the receiving devices of the handling device in order to simultaneously receive the substrates from the carriers and the processing stations or to be able to deposit them thereupon.

The invention will be subsequently described in detail with the aid of preferred embodiments with reference to the figures. Shown are:

Figure 1 a plan view of an arrangement having an apparatus for the loading and unloading of substrates pursuant to a first embodiment of the invention;

Figure 2 a plan view of an arrangement having an apparatus for the loading and unloading of substrates pursuant to a second embodiment;

Figure 3 a plan view of an arrangement having an apparatus for the loading and unloading of substrates pursuant to a third embodiment.

Figure 1 shows an arrangement 1 for the processing of CD's. The arrangement 1 comprises a first embodiment of an apparatus 2 for the loading and unloading of substrates pursuant to the present invention, and is provided with a linear conveying device 3 and two
5 handling devices 4 and 5. The arrangement 1 is furthermore provided with eight processing stations 6A to D and 7A to D, upon which the CD's are processed. The arrangement 1 is disposed on a foundation or support means 8, which is, for example, a mineral ingot.

The handling device 4, the processing stations 6A to D and the
10 linear conveying device 3 together form a first group of the arrangement 1. Further, the handling device 5, the processing stations 7A to D, together with the linear conveying device 3 form a second group of the arrangement 1 that corresponds to the first group. The first and the second group of the arrangement together utilize the
15 single linear conveying device 3.

The linear conveying device 3 of the apparatus 2 of the first embodiment has a conveyor belt 13 that runs along a track or line 14. At the reversing ends 15 and 16 of the conveying device 3, the conveyor belt 13 is mounted on an idler roller 13 and a drive roller 18
20 respectively. Provided at the end 16 of the linear conveying device 3 is a drive means 19. The drive means 19 is a servomotor having a suitable, non-illustrated control device, and driving the drive roller 18 for the transport of the conveyor belt 13.

The linear conveying device 3 has a central axis 20, which at the same time is the central axis of the conveyor belt 13.

Carriers for CD's that are not shown are disposed on the conveyor belt 13. In Figure 1, eight carriers 21 to 28 are shown. The carriers 21 to 28 are disposed on the central axis 20 of the conveyor belt 13 at a uniform spacing d.

Disposed adjacent to the reversing ends 15 and 16 of the conveying device 3 are non-illustrated handling devices for the loading and unloading of the CD's. In Fig. 1, the CD's at the reversing end 15 are placed upon the conveyor belt 13 by a suitable, non-illustrated handling device, and at the reversing end 16, after the processing, the CD's are again removed by a further suitable, non-illustrated handling device.

The handling devices 4 and 5 are held from above over the conveyor belt 13 such that via suitable drive means they are not only rotatable but also adjustable in height. Since the handling devices 4 and 5 are essentially identical, in the following only the handling device 4 will be described.

The axis of rotation of the handling device 4 extends through the center point 40 of a circumferential circle 41. The axis of rotation of the handling device 4 is disposed vertically upon the central axis 20 of the linear conveying device 3. The handling device 4 is provided with six respective receiving devices or receivers 42 to 47, which are disposed

upon six radially extending arms 48 to 53. The receivers 42 to 47 are suitable, for example by opening and closing, to receive and again deposit CD's and for this purpose are suitably controlled by a non-illustrated control device.

5 As can be seen from Figure 1, the receivers 42 to 48 of the handling device 4 are disposed upon the circumferential circle 41 and are uniformly spaced upon the circumferential circle 41. The six receivers 42 to 47 are respectively provided at an angle of $\alpha=60^\circ$ upon the circumferential circle 41.

10 The processing station 6A to 6D and 7A to 7D are associated with the two handling devices 4 and 5, as already indicated above. For this reason, in the following only the processing stations 6A to D are described, whereby a corresponding description is applicable for the processing stations 7A to D in conjunction with the handling device 5.

15 The processing stations 6A and 6C are lacquering or coating stations that have a rotary plate and pivotable coating nozzles. The processing stations are furthermore provided with central receiving points 60A and 60C for the CD's that are to be processed. The processing stations 6B and 6D are edge-cleaners having a rotary plate
20 and an edge scraper for cleaning the edges of the CD's after the coating process. The processing stations 6B and 6D are similarly provided with receivers having central receiving points 60B and 60D for receiving the CD's at the processing stations.

The central receiving points 60A to 60D are disposed upon the circumferential circle 41, and are disposed in pairs on the circumferential circle 41 diametrically opposite one another. Thus the central receiving points 60A and 60C, and the central receiving points 60B and 60D, respectively form a pair.

The processing stations that are disposed diametrically opposite one another on the circumferential circle 41 are the same type. The processing stations 6A and 6C are respectively coating stations, and the processing stations 6B and 6D are respectively edge-cleaning stations.

The central receiving points 60A to 60D are arranged in such a way that central receiving points of processing stations that are directly adjacent one another on the circumferential circle are spaced by the angle $\alpha=60^\circ$, and the central receiving points are respectively similarly spaced by an angle of $\alpha=60^\circ$, relative to a point of intersection of the central axis 20 of the conveying device with the circumferential circle 41.

The center points 40,65 of the circumferential circles 41, 66 of the first and second groups of the arrangement 1 are spaced upon the linear conveying device 3 by a distance equal to three times the spacing d between adjacent carriers. The diameters of the two circumferential circles 41 and 66 are the same, and correspond to two

times the spacing d between adjacent carriers upon the conveyor belt
3.

The arrangement 1 is shown with a specific number of
processing stations, although this number is only exemplary and can
5 be varied. In addition, the processing stations need not be coating and
edge-cleaning stations, but rather other processes can also be carried
out. It is also not necessary that different processes be provided.
Furthermore, instead of CD's, other substrates could also be
processed.

Figure 2 shows a second embodiment of the arrangement 1b
10 having a further, third handling device, which is the same as the
handling devices 4 and 5 of the first embodiment of Fig. 1. The third
handling device is similarly disposed over the conveying device 3b,
which is longer than the linear conveying device 3 of the first
15 embodiment. The axis of rotation of the third handling device is
disposed vertically upon the central axis 20b of the conveying device
3b. The third handling device, together with further four processing
stations, forms a third group of the arrangement 1b, whereby the four
processing stations are again two coating stations and two edge-
20 cleaning stations.

The central receiving points of CD receivers of the processing
stations, as well as the receivers of the handling devices of the
respective groups, are disposed upon respective circumferential

circles, the center points of which are disposed upon the central axis 20b of the conveying device 3b and coincide with the axis of rotation of the handling devices, as can be seen from Figure 2.

5 The diameters of the respective circumferential circles are the same. In the embodiment of Figure 2, the diameters of the circumferential circles correspond to three times the spacing d between adjacent carriers 21b to 36b of the conveying device 3b. The center points of adjacent circumferential circles are disposed upon the central axis 20b of the conveying device 3b at a spacing that corresponds to
10 four times the spacing d between two adjacent carriers of the conveying device 3b.

As will be described subsequently in detail in conjunction with the preferred manner of operation of the arrangement 1 or 1b, the first embodiment and the second embodiment also differ with regard to the
15 loading of the carriers of the conveying device 3 or 3b with CD's.

Figure 3 shows an arrangement 1a that has a third embodiment of an apparatus 2a pursuant to the present invention. The apparatus 2a has a linear conveying device 3a and a rotatable handling device 4a. The arrangement 1a furthermore has processing stations 80A to
20 H.

The linear conveying device 4a has a track or line 14a upon which is disposed a conveyor belt 13a. As described above for the conveyor belt 13 of the first embodiment, the conveyor belt 13a also

extends between two reversing ends 15a and 16a of the linear conveying device 3a, and is driven by means of a drive roller 18a at the reversing end 16a by a suitable drive means 19a, such as a controlled servomotor.

5 The conveying device 3a has a central axis 20a that is also the central axis of the conveyor belt 13a. Carriers for CD's are disposed upon the conveyor belt 13a. In Figure 3, carriers 21a to 28a are visible. The carriers are disposed in pairs symmetrically relative to the central axis. For example, the carriers 21a and 28a, or the carriers 22a
10 and 27a, form a symmetrical pair relative to the central axis 20a.

 The handling device 4a is held from above over the conveyor belt 13a and is disposed such that, via a suitable drive means, it is not only rotatable but also adjustable in height. The axis of rotation of the handling device 4a is disposed perpendicular upon the central axis 20a
15 of the linear conveying device 3a. The handling device 4a has twelve receivers 400a to 411a on corresponding radially extending arms 420a to 431a. The receivers 400a to 411a serve for receiving and depositing CD's, and for this purpose are suitably controlled by a non-illustrated control device.

20 As shown in Figure 3, the receivers 400a to 411a are disposed on a circumferential circle 41a, whereby the axis of rotation of the rotatable handling device 4a extends through the center point 40a of the circumferential circle 41a. The receivers 400a to 411a are

uniformly spaced from one another upon the circumferential circle at an angle $\alpha=30^\circ$.

The diameter of the circumferential circle 41a is such that in the position of the apparatus 2a shown in Figure 3, a total of two pairs of carriers, which are symmetrical relative to the central axis 20a, are disposed on the conveyor belt 13a on the circumferential circle 41a. In tangible terms, in Figure 3, this is the pair of carriers 23a, 26a and 22a, 27a. Accordingly, the diameter of the circumferential circle 41a corresponds to the spacing between the carriers 22a and 26a or between the carriers 23a and 27a.

The processing stations 80A to 80H shown in Fig. 3 are either coating stations 80A to 80D for coating CD's or edge-cleaning stations 80E to 80H. The coating stations 80A to 80D have rotary plates, pivotable coating nozzles, and receivers having respective central receiving points 81A to 81H for the CD's that are to be processed. The edge-cleaning stations 80E to 80H have rotary plates, edge scraper, and receivers having central receiving points 81E to 81H.

Respective central receiving points 81A to 81H of the processing stations 80A to 80H are disposed upon the circumferential circle 41a, and are disposed in pairs diametrically across from one another on the circumferential circle 41a. In this connection, the processing stations within these pairs are of the same type.

Furthermore, respectively two of the same type of processing stations are disposed adjacent to one another upon the circumferential circle 41A and are driven by a common drive means, although separate drive means could also be provided.

5 The manner of operation of the apparatus 2 pursuant to the first embodiment is briefly described in the following.

Disposed on the processing stations are already treated CD's, which were coated in the coating stations 6A, 6C and their edges were cleaned in the edge-cleaning stations.

10 During the treatment or processing of the CD's, the receivers 42 to 47 on the radial arms of the handling devices 4 are disposed in an intermediate position, i.e. they are disposed between adjacent processing stations. Thus, the handling devices 4 and 5 are positioned in such a way that none of the receivers 42 to 47 are disposed over the
15 processing stations. With reference to Figure 1, this means that the handling devices 4 and 5 are rotated out of their illustrated position by $\alpha/2=30^\circ$.

At the reversing end 15, the carriers of the conveyor belt are provided by the loading station with CD's that are to be processed.
20 After the loading or provision process, only those carriers of the conveyor belt 13 are to be loaded that are positioned upon the circumferential circles 41 and 66. With the arrangement 1 of Fig. 1, this is effected in such a way that initially a carrier at the reversing end

15 is provided by means of the loading station, the next one is not provided, the two following carriers are again provided, again a carrier is not provided, and finally one more carrier is provided with a CD that is to be processed. For this purpose, the conveyor belt is always
 5 cycled further by a distance d until finally all carriers that are provided with a CD are disposed upon one of the circumferential circles 41 or 66. In Figure 1, these are the carriers 22, 24, 25 and 27.

During the loading of the carriers, already processed CD's are removed from the conveyor belt from a preceding operating cycle at
 10 the reversing end 16 by the unloading station.

As soon as the loaded carriers 22,24,25 and 27 are disposed upon the circumferential circles 41 or 46, the handling devices 4 and 5 are rotated into the position shown in Figure 1, in which the receivers 42 to 47 are disposed either over the central receiving points 60A to 60C or over the carriers 22 and 24. The same applies for the second
 15 group of the arrangement 1, which comprises the handling device 5, the four processing stations 7A to 7C, and the conveyor belt 13.

In this position, the receivers 42 to 47 are lowered for engaging the CD's and are subsequently again raised. In this connection, the
 20 unprocessed CD's and the processed CD's are simultaneously taken up and raised together from the carriers and from the receivers of the processing stations respectively.

With the taken-up CD's, the handling device 4 is rotated in a clockwise direction by an angle $\alpha=60^\circ$. In this connection, for example, the unprocessed CD taken up by the carrier 22 is transported to the central receiving point 60A of the processing station 6A, and the CD taken up by the coating station 6A is transported to the edge-cleaning station 6b, etc..

In the new position, the receivers are lowered and place these CD's either upon the central receiving points of the processing stations or upon the carriers of the conveyor belt 13.

After the CD's have been deposited upon the carriers and the processing stations, the handling device 4 is again rotated into an intermediate or park position in which the arms 48 to 53, and hence the receivers of the handling device, are disposed between adjacent processing stations. The same applies for the second handling device 5 and the receivers thereof.

During the processing of the CD's in the coating and edge-cleaning stations, the conveyor belt 13 is unloaded and is re-supplied or loaded with CD's that are to be processed, as described previously.

The arrangement 1b of Figure 2 differs from the arrangement 1 of Figure 1 essentially in that a third group, comprising a third handling device and four corresponding processing stations, is disposed along the lengthened conveying device 3b.

From this there results a difference during the operation of the loading and unloading apparatus of Fig. 2 relative to that of Fig. 1. The carriers of the conveyor belt are provisioned with CD's by the loading station at the reversing end 15b in such a way that between two carriers that are provided with CD's, and that are disposed upon a common circumferential circle of a respective group, two carriers remain free, which after the provision of the conveyor belt are disposed below the handling devices. Thus, after the first carrier is provided with a CD, two carriers are left free, then again two carriers are provisioned, and then again two carriers are left free, etc.. For the receipt and the deposition of the CD's by the receivers of the handling devices, the conveyor belt 13b is positioned into the position shown in Figure 2, whereby the loaded carriers are disposed upon the respective circumferential circles of the handling devices.

The three handling devices are then controlled for the transport of the CD's upon the processing station and upon the carriers, as was described in conjunction with the manner of operation of the arrangement of Fig. 1.

With the arrangement 1a of Figure 3, the concept of the invention is extended further in that for the one handling device 4a a total of twelve receivers 400a to 411a are provided. In the position shown in Figure 3, four unprocessed CD's can be simultaneously accommodated by the receivers from the carriers 22a, 27a, 23a and

26a and from the central receiving points 81A to 81H of the processing stations 80A to 80H. After the raising of the CD's, the handling device 4a is rotated by an angle $2\alpha=60^\circ$, in other words twice the angular spacing between two adjacent receivers upon the circumferential circle 41a. Thus, simultaneously a total of four CD's are supplied to the coating stations 80A to 80D, four CD's are supplied to the edge-cleaning stations 80E to 80H, and four processed CD's are supplied to the carriers 22a, 27a, 23a, and 26a. After the deposit of the CD's, the handling device 4a is rotated into an intermediate position, as with the preceding embodiments, in which the receivers are disposed between the processing stations or the carriers, or a processing station and a carrier. The processed CD's can thereupon be transported to the unloading station, the carriers can be supplied via the loading station with new CD's that are to be processed, and the CD's can be processed upon the processing stations.

The invention was described with the aid of preferred embodiments of the invention without thereby being limited to the special embodiments.

For example, the arrangements of Fig. 1 and Fig. 2 can be expanded by further groups that comprise a handling device similar to the handling devices 4 and 5 and having a suitable number of processing stations, and in particular accompanied by appropriate extension of the linear conveying device 3. In this connection, care

5

must be taken that the diameters of the respective circumferential circles have a suitable ratio to the spacings d of adjacent carriers upon the conveyor belt 13, 13a or 13b, and that only those carriers be loaded with CD's that are then disposed upon the corresponding circumferential circles. Furthermore, instead of CD's also other substrates can be processed, or the linear conveying device could also be realized in a manner different than by the conveyor belt 13, 13a or 13b.

PATENT CLAIMS

1. Apparatus (1;1a;1b) for the loading and unloading of substrates and including a conveying device (3;3a;3b) for the linear transport of the substrates and at least one rotatable handling device (4, 5; 4a) for the transport of the substrates between the conveying device (3; 3a;3b) and at least one processing station (6A to D, 7A to D; 80A to H), characterized in that the conveying device (3; 3a; 3b) is disposed between at least two processing stations (6A to D, 7A to D; 80A to H) and the at least one handling device (4, 5; 4a) is disposed above the conveying device (3; 3a; 3b).
2. Apparatus according to claim 1, characterized in that the point of rotation (40, 65; 40a) of the handling device (4, 5; 4a) is disposed on a central axis (20; 20b; 20a) of the conveying device (3; 3a; 3b).
3. Apparatus according to claim 1 or 2, characterized in that the handling device (4, 5; 4a) is provided with receivers (42 to 47; 400a to 411a) disposed on a circumferential circle (41,66; 41a) for the substrates.
4. Apparatus according to claim 3, characterized in that the receivers (42 to 47; 400a to 411a) are uniformly spaced upon the circumferential circle (41, 66; 41a).

5. Apparatus according to one of the claims 3 or 4, characterized in that the receivers (42 to 47; 400a to 411a) are disposed on radial arms (48 to 53; 420 to 431) of the handling device (4, 5; 4a).
- 5 6. Apparatus according to one of the preceding claims, characterized in that the conveying device (3; 3a; 3b) is provided with a conveyor belt (13; 13a; 13b).
7. Apparatus according to claim 6, characterized in that the conveyor belt (13; 13a; 13b) extends between a loading station
10 and an unloading station.
8. Apparatus according to claim 6 or 7, characterized in that the conveyor belt (13; 13a; 13b) is provided with carriers (21 to 28; 21a to 28a) for the substrates.
9. Apparatus according to claim 8, characterized in that the carriers
15 (21 to 28; 21a to 28a) are uniformly spaced apart in the direction of movement of the conveyor belt (13; 13a; 13b).
10. Apparatus according to claim 8 or 9, characterized in that the carriers (21 to 28) are disposed on the central axis (20; 20a; 20b) of the conveyor belt (13; 13b).
- 20 11. Apparatus according to claim 8 or 9, characterized in that respectively at least two carriers (21a to 28b) are symmetrically disposed relative to the central axis (20a) of the conveyor belt (13a).

12. Apparatus according to one of the preceding claims, characterized in that at least two carriers (21 to 28; 21a to 28a) are disposed upon the circumferential circle (41, 66; 41a) for the loading and unloading of the substrates.
- 5 13. Apparatus according to claim 3, characterized in that central receiving points (60A to D; 81A to H) of the processing stations (6A to D; 80A to H) are disposed upon the circumferential circle (41; 41a).
- 10 14. Apparatus according to claim 12 or 13, characterized in that the processing stations (6A to D, 7A to D; 80A to H) are disposed in pairs diametrically opposite one another upon the circumferential circle (41, 66; 41a).
- 15 15. Apparatus according to claim 14, characterized in that the processing stations (6A to D, 7A to D; 80A to H) are of the same type within the pairs.
16. Apparatus according to one of the preceding claims, characterized in that processing stations (80A to H) that are disposed adjacent to one another upon the circumferential circle (41a) are driven with the same drive means.
- 20 17. Apparatus according to one of the claims 3 to 16, characterized in that the number of the receivers (42 to 47; 400a to 411a) of the handling device (4; 4a) corresponds to the number of the carriers (22, 24; 22a, 23a, 26a, 27a) disposed upon the

circumferential circle (41; 41a) and of the processing stations(6a to D; 80A to H).

18. Apparatus according to claim 17, characterized in that during the loading and unloading all of the receivers (42 to 47; 400a to 411a) are disposed either over the carriers (22, 24, 25, 27; 22a, 23a, 26a, 27a) on the conveying device (3; 3a; 3b) or over the central receiving points of the processing stations (6A to D, 7A to D; 80A to H).
19. Apparatus according to one of the preceding claims, characterized by a control device for the simultaneous opening and closing of the receivers (42 to 47; 400a to 411a).

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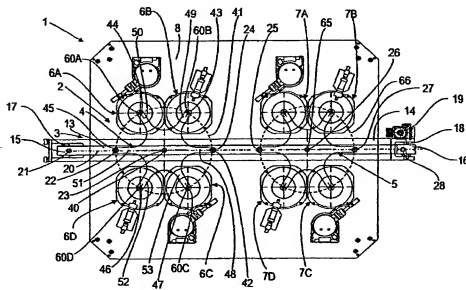
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[Fortsetzung auf der nächsten Seite]

(54) Title: DEVICE FOR LOADING AND UNLOADING SUBSTRATES

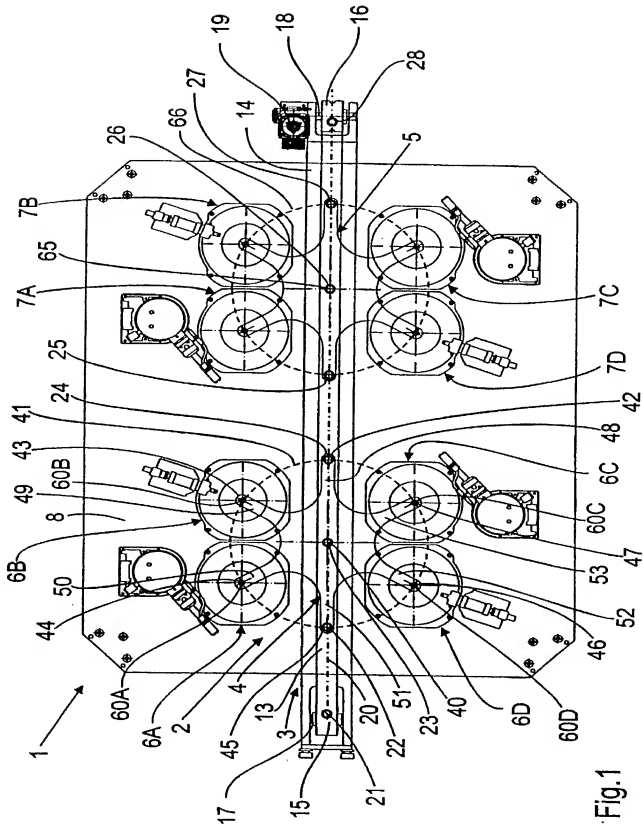
(54) Bezeichnung: VORRICHTUNG ZUM BE- UND ENTLADEN VON SUBSTRATEN



(57) Abstract: The invention relates to a device (1; 1a; 1b) for loading and unloading of substrates using a conveyor device (83; 3a; 3b) which is used to convey a substrate in a linear manner comprising at least one handling facility which can be rotated (4; 5; 4a) and which is intended for the transport of said substrate between said conveyor device (3; 3a; 3b) and at least one process station (6A to D, 7A to D; 80A to H) wherein a small number of components are used and a small amount of space is taken up when the conveyor device (3; 3a; 3b) is arranged between at least two process stations (6A to D, 7A to D; 80A to H) and the at least one handling facility (4; 5; 4a) above said conveyor device (3; 3a; 3b).

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WO 01/22477 A1



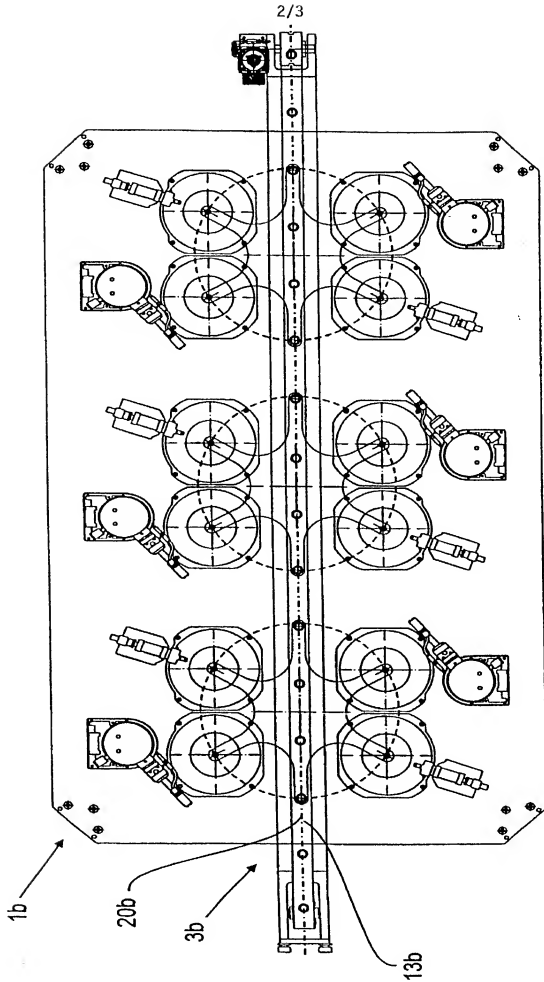


Fig. 2

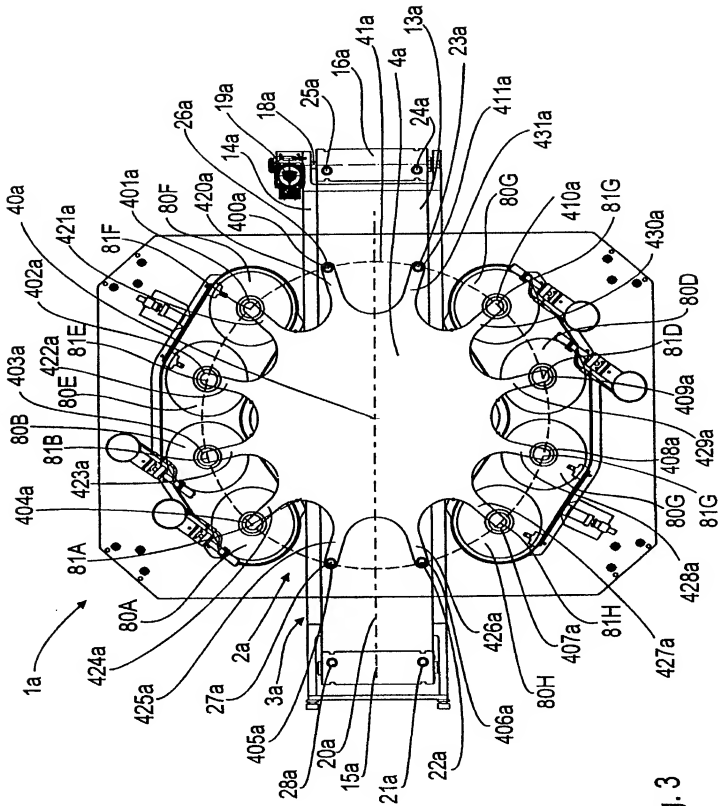


Fig. 3



Attorney Docket No.
AZ.3129

COMBINED DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION

As below named inventors, we hereby declare that.

Our residences, post office addresses and citizenships are as stated below next to our names; we believe we are the original, first and joint inventors of the subject matter which is claimed and for which a patent is sought of the invention entitled:

APPARATUS FOR THE LOADING AND UNLOADING OF SUBSTRATES

the specification of which,

is attached hereto;
was filed on 20 September 2000 as International Application Ser. No. PCT/EP00/09177 and is amended herewith as US Serial No. 10/089,196 of March 22, 2002.

We hereby state that we have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

We acknowledge the duty to disclose all information known by me to be material to the patentability of this application in accordance with Title 37, Code of Federal Regulations, Section 1.56.

We hereby claim foreign priority benefits under Title 35, United States Code, Section 119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s).

Priority
Declared:

(Number)	(Country)	(Day/Month/Year Filed)	Yes	No
199 45 648.8	Germany	23 September 1999	X	

We hereby claim the benefit under 35 U.S.C. § 119(e) of any United States provisional application(s) listed below:

(Application Number)	(Filing Date)

We hereby appoint attorney Robert W. Becker, Reg. No. 26,255, to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith. Address all telephone calls to (505) 286-3511. Address all correspondence to ROBERT W. BECKER & ASSOCIATES, 707 Highway 66 East, Suite B, Tijeras, New Mexico 87059.

We hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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Decl. - Pg. 2
Attorney Docket No.
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